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Environmental Radiation Data: Report 55, July-September 1988

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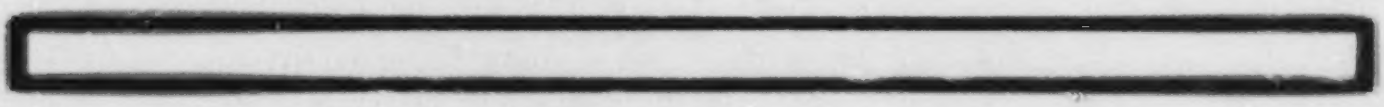

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Montgomery, AL 36109

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Environmental Radiation Data

Report 55

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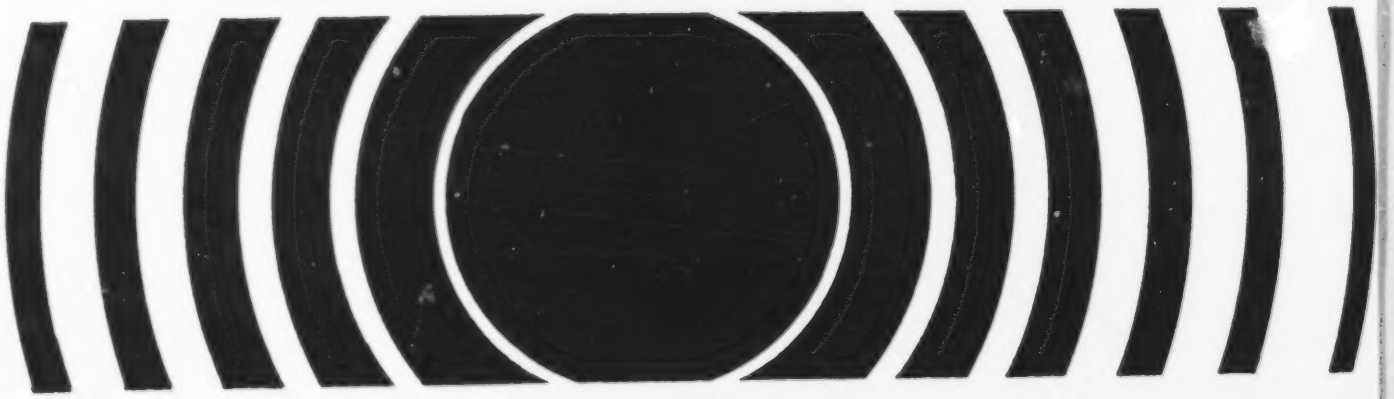

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ENVIRONMENTAL RADIATION DATA

REPORT 55

July - September 1988

United States Environmental Protection Agency

Office of Radiation Programs

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16. ABSTRACT

Environmental Radiation Data (ERD) contains data from the Environmental Radiation Ambients Monitoring System (ERAMS). Data from similar networks operated by contributing States, Canada, Mexico, and the Pan American Health Organization are reporoted in the ERD when availbable.
The ERAMS is comprised of nationwide sampling stations that provide air, surface and drinking water and milk samples from which environmental radiation levels are derived. Sampling locations are selected to provide optimal population coverage while functioning to monitor fallout from nuclear devices and other forms of radioactive contamination of the environment. The radiation analyses performed on these samples include gross alpha and gross beta levels, gamma analyses for fission products, and specific analyses for uranium, plutonium, strontium, iodine, radium, krypton, and tritium.

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Data Radiation Concentrations Monitoring Radionuclides Analysis Sampling		

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Preface

Environmental Radiation Data (ERD) is compiled and distributed quarterly by the Office of Radiation Programs' Eastern Environmental Radiation Facility (EERF) in Montgomery, Alabama, and contains data from the Environmental Radiation Ambient Monitoring System (ERAMS). Data from similar networks operated by contributing States, Canada, Mexico, and the Pan American Health Organization are reported in the ERD when available.

ERAMS was established in 1973 by the U. S. Environmental Protection Agency's Office of Radiation Programs (ORP). The ERAMS is comprised of nationwide sampling stations that provide air, surface and drinking water, and milk samples from which environmental radiation levels are derived. The major emphasis for ERAMS is upon identifying trends in the accumulation of long-lived radionuclides in the environment.

Sampling locations are selected to provide optimal population coverage while functioning to monitor fallout from nuclear devices and other forms of radioactive contamination of the environment. The radiation analyses performed on these samples include gross alpha and gross beta levels, gamma analyses for fission products, and specific analyses for uranium, plutonium, strontium, iodine, radium, krypton, and tritium. This monitoring effort also provides ancillary information on natural background levels and on routine and accidental releases into the environment from stationary sources.

The radiochemical procedures used by the EERF to analyze the ERAMS samples are contained in *Eastern Environmental Radiation Facility Radiochemistry Procedures Manual* (EPA 520/5-84-006). Station operation and sample collection are in accordance with procedures contained in the *ERAMS Manual* (EPA 520/5-84-007, 008, 009).

Environmental Radiation Data

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DATA - Reporting Rationale and Procedures

In 1973, the U.S. Environmental Protection Agency's Office of Radiation Programs established the Environmental Radiation Ambient Monitoring System (ERAMS) to provide continuous, accurate, and usable environmental radiation data to the public. For completeness, ERAMS data for all specific radionuclide analyses are reported as the calculated results indicate, whether the numbers are negative, zero, or positive.

Reporting Rationale

Frequently, there is little or no radioactivity in environmental media. Thus, the results of laboratory analyses should statistically show a distribution of negative and positive numbers about zero. A negative value occurs when a previously determined background value is subtracted from a sample value that is less than that of the background. Prior to July 1975, ERAMS data were not reported numerically when the results were less than a specified reporting level or minimum detectable level. The present reporting procedure allows all the data to be reported and evaluated statistically without an arbitrary cutoff of small or negative numbers. This approach will facilitate estimates of bias in the nuclide analyses and will allow better evaluation of distributions and trends in environmental data.

When reviewing the data in this report, caution should be exercised in the interpretation of individual negative values. Obviously, a negative activity value has no physical significance. Such numbers, however, are significant when taken together with other observations that indicate that the true value of a distribution is near zero. When an average of many measurements produces a result significantly less than zero, this indicates a bias in the measurement procedure.

(1) *Reported Values*

Specific Analyses. All specific radionuclide analyses will be reported as the counting results indicate, whether the value is negative, zero, or positive. All reported values are corrected for radioactive decay to the collection date.

Gross Analyses. The actual value of gross radioactivity measurements will be reported, unless the value is below the minimum detectable level (MDL) at the 2σ confidence level, then $<$ minimum detectable level will be reported.

MDL is defined as the 3σ error of the background. A tabulation of typical MDL's is given in the following table.

(2) *Reported Error Terms*

Each reported value for specific analyses will be accompanied by a counting error term at the 2σ (95%) confidence interval. Error terms are therefore reported as counting errors. At the very low levels characteristic of most ERAMS measurements, counting error is the greatest contributor to overall error.

(3) *Significant Figures*

No more than three significant figures will be reported. If a datum contains more than three figures, it will be rounded off to three figures.

(4) *Reporting Levels*

The reporting units, smallest increments for reporting, and typical minimum detectable levels for each isotope are shown in Table 1. Reporting increments are sometimes considerably smaller than minimum detectable amounts to avoid truncation errors in averaging.

(5) *Averages*

Averages will be calculated along with appropriate error terms in an annual summary and analysis of ERAMS data. In calculating these averages, all values of individual data including negative numbers will be utilized. Averages will not be included in ERD quarterly reports.

Table 1

ERAMS Reporting Increments and Minimum Detectable Levels for Radionuclide Analyses

Radionuclide	Media	Reporting Units	Reporting Increments	Minimum Detectable Levels
Gross Alpha	Water	pCi/l	1 pCi/l	2 pCi/l
† Gross Beta	Air	pCi/m^3	0.01 pCi/m^3	0.01 pCi/m^3
	Water	pCi/l	1 pCi/l	1 pCi/l
	Precipitation	nCi/m^2	0.01 nCi/m^2	0.01 nCi/m^2
	(specific radiochemical analyses)			
Tritium	Water	nCi/l	0.1 nCi/l	0.2 nCi/l
	Milk	nCi/l	0.1 nCi/l	0.2 nCi/l
Carbon-14	Milk	pCi/l	1 pCi/l	15 pCi/l
Krypton-85	Ambient Air	pCi/m^3	0.1 pCi/m^3	2 pCi/m^3
†† Plutonium-238,239,240	Air	aCi/m^3	0.1 aCi/m^3	0.015 pCi
	Milk	pCi/l	0.001 pCi/l	0.015 pCi
	Water	pCi/l	0.001 pCi/l	0.015 pCi
‡ Uranium-234,235,238	Air	aCi/m^3	0.1 aCi/m^3	0.015 pCi
	Milk	pCi/l	0.001 pCi/l	0.015 pCi
	Water	pCi/l	0.001 pCi/l	0.015 pCi
Radium-226	Water	pCi/l	0.1 pCi/l	0.1 pCi/l
Strontium-90	Milk	pCi/l	0.1 pCi/l	1 pCi/l
	Water	pCi/l	0.1 pCi/l	1 pCi/l
‡‡ Strontium-89	Milk	pCi/l	1 pCi/l	5 pCi/l
‡‡ Iodine-131	Milk	pCi/l	1 pCi/l	10 pCi/l
	Water	pCi/l	1 pCi/l	10 pCi/l
	Water	pCi/l	0.1 pCi/l	0.4 pCi/l
Iodine-129	Milk	fCi/l	0.1 fCi/l	0.4 fCi/l
Cesium-137	Milk	pCi/l	1 pCi/l	10 pCi/l
	Water	pCi/l	1 pCi/l	10 pCi/l
‡‡ Barium-140	Milk	pCi/l	1 pCi/l	10 pCi/l
	Water	pCi/l	1 pCi/l	10 pCi/l
Potassium	Milk	g/l	0.1 g/l	0.12 g/l
	Water	g/l	0.1 g/l	0.12 g/l
Potassium-40	Water	pCi/l	1 pCi/l	100 pCi/l

† The value of MDL for precipitation in terms of nCi/m^2 would be dependent on precipitation (mm).

†† This value of MDL for air in terms of pCi/m^3 would be dependent on the air volume. Measurement by alpha spectroscopy that includes contributions of plutonium-239 and plutonium-240. MDL for all media given per sample.

‡ This value of MDL for air in terms of pCi/m^3 would be dependent on the air volume. MDL for all media given per sample.

‡‡ Activity as of the day of counting.

ENVIRONMENTAL RADIATION AMBIENT MONITORING SYSTEM (ERAMS)

Section I. Air Program

Airborne Particulates and Precipitation

Gross beta radioactivity measurements and certain specific analyses are performed on air particulates and precipitation samples as indicator measurements in assessing the general (national) impact of all contributing sources on environmental levels of radiation.

Airborne particulates are collected continuously at field stations representing wide geographic coverage, including present and potential sources of environmental radioactivity. Sampling sites are located throughout the United States.

Filters (10-cm diameter synthetic fiber) from air samplers are changed twice weekly and field measurements are made with a G-M survey meter [1] at 5 hours and 29 hours after collection to allow for radon and thoron daughter product decay. Field estimates are reported to appropriate EPA officials by telephone or mail depending on the activity levels found.

The filters are sent to EERF for more sensitive analyses in a low background beta counter. Gamma scans are performed on all filters showing gross beta counts greater than 1 pCi/m^3. The laboratory obtained values are usually lower than the field estimates due to the decay of naturally occurring radionuclides between the times of the two measurements.

Precipitation samples are collected at those field stations collecting air filters. These samples are also sent to EERF where they are composited monthly for gamma scans, tritium, and gross beta activity measurements. A composite of the March, April, and May precipitation samples is analyzed for plutonium-238, -239, -240, and uranium-234, -235, and -238.

A compilation of individual measurements is available from the Eastern Environmental Radiation Facility, 1890 Congressman W.L. Dickinson Drive, Montgomery, AL 36109.

Tables 2-4 contain the data in airborne particulate samples for July - September 1988. Tables 5-7 contain the data in precipitation sample for July - September 1988. Table 8 contains the data for tritium in precipitation samples for July - September 1988 at the selected sites.

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[1] The counts at five hours for the Montgomery, Alabama, station are performed on a low background beta counter.

Table 2

Airborne Particulates
Gross Beta Concentrations

July 1988

Location	Number of Samples	5-Hour Field Estimate (pCi/m^3)			EERF Lab Measurment (pCi/m^3)		
		Max	Min	Avg	Max	Min	Avg
AL:MONTGOMERY	8	1.0	0.0	0.3	0.02	0.01	0.01
AR:LITTLE ROCK	9	0.5	0.5	0.5	0.02	0.01	0.01
AZ:PHOENIX	6	2.3	0.0	0.5	0.01	0.01	0.01
CA:BERKELEY	9	0.0	0.0	0.0	0.01	0.00	0.00
CA:LOS ANGELES	9	0.2	0.1	0.1	0.01	0.00	0.01
CO:DENVER	8	0.9	0.2	0.6	0.03	0.01	0.01
CT:HARTFORD	9	0.3	0.1	0.1	0.02	0.00	0.01
DE:WILMINGTON	7	0.4	0.0	0.2	0.02	0.01	0.01
FL:JACKSONVILLE	8	0.1	0.0	0.1	0.02	0.00	0.01
FL:MIAMI	9	0.1	0.0	0.0	0.01	0.00	0.00
HI:HONOLULU	9	0.3	0.1	0.2	0.00	0.00	0.00
IA:IOWA CITY	8	0.6	0.1	0.3	0.02	0.01	0.01
ID:BOISE	6	0.6	0.2	0.3	0.04	0.01	0.02
ID:IDAHO FALLS	8	0.0	0.0	0.0	0.01	0.01	0.01
IL:CHICAGO	8	1.1	0.1	0.5	0.02	0.01	0.01
IN:INDIANAPOLIS	9	0.9	0.2	0.5	0.03	0.01	0.02
KS:TOPEKA	6	1.6	0.6	1.2	0.02	0.01	0.01
KY:FRANKFORT	4	0.5	0.2	0.4	0.02	0.01	0.01
LA:NEW ORLEANS	3	0.1	0.0	0.0	0.02	0.01	0.01
MA:LAWRENCE	9	0.3	0.0	0.2	0.02	0.00	0.01
ME:AUGUSTA	8	0.3	0.1	0.2	0.02	0.00	0.01
MI:LANSING	8	1.6	0.2	0.5	0.02	0.00	0.01
MN:MINNEAPOLIS	9	0.7	0.1	0.4	0.02	0.01	0.01
MO:JEFFERSON CITY	8	2.6	0.2	1.0	0.11	0.01	0.04
MS:JACKSON	7	0.3	0.1	0.2	0.03	0.01	0.02
NC:CHARLOTTE	9	0.4	0.0	0.2	0.03	0.01	0.01
NC:WILMINGTON	5	0.0	0.0	0.0	0.01	0.00	0.01
ND:BISMARCK	9	1.4	0.5	0.9	0.06	0.01	0.02
NE:LINCOLN	9	3.2	0.7	1.5	0.05	0.01	0.02
NH:CONCORD	9	0.4	0.1	0.2	0.02	0.00	0.01
NJ:TRENTON	8	0.8	0.0	0.4	0.01	0.00	0.01
NM:SANTA FE	7	0.5	0.1	0.3	0.01	0.01	0.01
NV:LAS VEGAS	8	0.2	0.1	0.2	0.06	0.01	0.02
NY:ALBANY	4	0.1	0.0	0.1	0.01	0.00	0.01
NY:NEW YORK CITY	9	0.5	0.2	0.3	0.02	0.01	0.01
NY:NIAGARA FALLS	8	0.4	0.2	0.3	0.02	0.00	0.01
NY:SYRACUSE	6	0.7	0.1	0.3	0.02	0.00	0.01

Table 2 (continued)

Airborne Particulates
Gross Beta Concentrations

July 1988

Location	Number of Samples	5-Hour Field Estimate (pCi/m³)			EERF Lab Measurment (pCi/m³)		
		Max	Min	Avg	Max	Min	Avg
NY:YAPHANK	8	0.3	0.1	0.2	0.02	0.00	0.01
OH:COLUMBUS	8	0.4	0.1	0.2	0.03	0.01	0.01
OH:PAINESVILLE	9	1.3	0.1	0.4	0.03	0.00	0.02
OH:TOLEDO	8	0.4	0.1	0.4	0.03	0.01	0.01
OK:OKLAHOMA CITY	6	0.6	0.3	0.5	0.02	0.01	0.01
OR:PORTLAND	9	0.0	0.0	0.0	0.01	0.00	0.00
PA:GOLDSBORO	8	1.2	0.1	0.4	0.02	0.01	0.01
PA:HARRISBURG	9	0.5	0.1	0.3	0.02	0.00	0.01
PA:PITTSBURGH	9	0.2	0.2	0.2	0.03	0.01	0.01
PA:THREE MILE ISLAND	9	1.5	0.1	0.6	0.02	0.01	0.01
RI:PROVIDENCE	8	0.5	0.1	0.2	0.02	0.00	0.01
SC:BARNWELL	2	0.0	0.0	0.0	0.01	0.01	0.01
SC:COLUMBIA	9	0.3	0.1	0.2	0.04	0.01	0.02
SD:PIERRE	8	0.8	0.2	0.3	0.01	0.01	0.01
TN:KNOXVILLE	8	0.6	0.1	0.3	0.02	0.01	0.01
TN:NASHVILLE	8	1.1	0.0	0.4	0.02	0.01	0.01
TX:AUSTIN	7	0.3	0.1	0.2	0.01	0.01	0.01
TX:EL PASO	9	0.5	0.2	0.4	0.04	0.01	0.02
VA:LYNCHBURG	9	1.4	0.1	0.6	0.02	0.01	0.01
WA:OLYMPIA	9	0.2	0.0	0.1	0.01	0.00	0.00
WA:SPOKANE	8	0.3	0.2	0.2	0.02	0.00	0.01
WI:MADISON	8	1.0	0.3	0.7	0.03	0.00	0.01
WV:CHARLESTON	7	0.9	0.0	0.4	0.03	0.01	0.02

Minimum Detectable Limit for field estimates - 0.1 pCi/m³.
Minimum Detectable Limit for laboratory measurement - 0.01 pCi/m³.

Table 3

Airborne Particulates
Gross Beta Concentrations

August 1988

Location	Number of Samples	5-Hour Field Estimate (pCi/m³)			EERF Lab Measurment (pCi/m³)		
		Max	Min	Avg	Max	Min	Avg
AL:MONTGOMERY	8	1.3	0.2	0.6	0.03	0.00	0.02
AR:LITTLE ROCK	9	0.9	0.2	0.5	0.05	0.01	0.02
AZ:PHOENIX	8	1.1	0.3	0.7	0.06	0.01	0.02
CA:BERKELEY	9	0.0	0.0	0.0	0.01	0.00	0.00
CA:LOS ANGELES	9	0.2	0.0	0.1	0.01	0.01	0.01
CO:DENVER	9	1.4	0.3	0.7	0.03	0.01	0.01
CT:HARTFORD	9	0.2	0.0	0.1	0.02	0.00	0.01
DE:WILMINGTON	1	0.1	0.1	0.1	0.01	0.01	0.01
FL:JACKSONVILLE	9	0.1	0.0	0.1	0.01	0.00	0.01
FL:MIAMI	9	0.0	0.0	0.0	0.01	0.00	0.01
HI:HONOLULU	8	0.2	0.1	0.1	0.00	0.00	0.00
IA:IOWA CITY	9	0.3	0.0	0.1	0.02	0.01	0.01
ID:BOISE	9	0.7	0.2	0.4	0.03	0.01	0.02
ID:IDAHO FALLS	8	0.0	0.0	0.0	0.02	0.01	0.01
IL:CHICAGO	9	0.7	0.2	0.4	0.04	0.01	0.02
IN:INDIANAPOLIS	6	0.5	0.2	0.4	0.05	0.01	0.02
KS:TOPEKA	7	2.5	0.9	1.7	0.02	0.01	0.01
KY:FRANKFORT	5	0.9	0.3	0.6	0.04	0.01	0.03
LA:NEW ORLEANS	6	0.1	0.0	0.1	0.01	0.00	0.01
MA:LAWRENCE	7	0.2	0.1	0.1	0.02	0.01	0.01
ME:AUGUSTA	6	0.1	0.0	0.1	0.01	0.00	0.00
MI:LANSING	9	0.6	0.1	0.2	0.02	0.01	0.01
MN:MINNEAPOLIS	9	0.4	0.1	0.2	0.04	0.01	0.01
MO:JEFFERSON CITY	8	2.3	0.2	0.9	0.08	0.01	0.03
MS:JACKSON	8	0.5	0.1	0.3	0.03	0.00	0.01
NC:CHARLOTTE	9	0.3	0.0	0.2	0.02	0.00	0.01
NC:WILMINGTON	9	0.0	0.0	0.0	0.01	0.01	0.01
ND:BISMARCK	9	2.1	0.3	0.9	0.06	0.01	0.03
NE:LINCOLN	8	2.7	1.1	1.6	0.09	0.01	0.03
NH:CONCORD	9	0.5	0.1	0.2	0.01	0.00	0.01
NJ:TRENTON	9	1.2	0.1	0.5	0.02	0.00	0.01
NM:SANTA FE	8	0.6	0.1	0.2	0.02	0.01	0.01
NV:LAS VEGAS	9	0.2	0.1	0.2	0.05	0.01	0.02
NY:ALBANY	5	0.1	0.0	0.1	0.02	0.01	0.01
NY:NEW YORK CITY	9	0.5	0.2	0.3	0.02	0.01	0.01
NY:NIAGARA FALLS	9	0.6	0.2	0.3	0.02	0.01	0.02
NY:SYRACUSE	5	0.2	0.0	0.1	0.02	0.01	0.01

Table 3 (continued)

Airborne Particulates
Gross Beta Concentrations

August 1988

Location	Number of Samples	5-Hour Field Estimate (pCi/m³)			EERF Lab Measurment (pCi/m³)		
		Max	Min	Avg	Max	Min	Avg
NY:YAPHANK	8	0.4	0.1	0.2	0.02	0.00	0.01
OH:COLUMBUS	8	0.5	0.1	0.3	0.04	0.01	0.02
OH:PAINESVILLE	9	0.6	0.1	0.3	0.03	0.01	0.02
OH:TOLEDO	9	0.5	0.1	0.2	0.02	0.01	0.01
OK:OKLAHOMA CITY	9	0.9	0.5	0.7	0.04	0.01	0.02
OR:PORTLAND	5	0.0	0.0	0.0	0.01	0.00	0.00
PA:GOLDSBORO	9	1.0	0.1	0.4	0.02	0.01	0.01
PA:HARRISBURG	9	0.6	0.1	0.3	0.02	0.01	0.01
PA:PITTSBURGH	8	0.5	0.5	0.5	0.04	0.01	0.02
PA:THREE MILE ISLAND	10	0.9	0.1	0.4	0.02	0.01	0.01
RI:PROVIDENCE	9	0.4	0.1	0.2	0.02	0.01	0.01
SC:BARNWELL	2	0.0	0.0	0.0	0.01	0.01	0.01
SC:COLUMBIA	9	0.7	0.1	0.3	0.03	0.01	0.01
SD:PIERRE	8	0.7	0.1	0.4	0.03	0.01	0.01
TN:KNOXVILLE	9	0.6	0.2	0.4	0.02	0.01	0.01
TN:NASHVILLE	9	0.7	0.1	0.4	0.02	0.01	0.02
TX:AUSTIN	7	0.3	0.1	0.2	0.03	0.00	0.01
TX:EL PASO	9	0.5	0.2	0.3	0.02	0.01	0.01
UT:SALT LAKE CITY	9	0.6	0.1	0.3	0.03	0.01	0.01
VA:LYNCHBURG	9	1.1	0.2	0.5	0.02	0.01	0.01
WA:OLYMPIA	9	0.2	0.1	0.1	0.01	0.00	0.01
WA:SPOKANE	9	0.6	0.2	0.3	0.02	0.01	0.01
WI:MADISON	8	1.1	0.1	0.5	0.02	0.01	0.01
WV:CHARLESTON	8	0.5	0.0	0.3	0.02	0.01	0.02

Minimum Detectable Limit for field estimates - 0.1 pCi/m³.
Minimum Detectable Limit for laboratory measurement - 0.01 pCi/m³.

Table 4

Airborne Particulates
Gross Beta Concentrations

September 1988

Location	Number of Samples	5-Hour Field Estimate (pCi/m³)			EERF Lab Measurment (pCi/m³)		
		Max	Min	Avg	Max	Min	Avg
AL:MONTGOMERY	8	0.5	0.3	0.4	0.03	0.01	0.01
AR:LITTLE ROCK	9	1.0	0.2	0.5	0.03	0.01	0.02
AZ:PHOENIX	4	0.7	0.3	0.5	0.04	0.01	0.02
CA:BERKELEY	9	0 0	0.0	0.0	0.02	0.00	0.01
CA:LOS ANGELES	9	0.5	0.0	0.2	0.03	0.01	0.02
CO:DENVER	9	3.2	0.3	1.0	0.03	0.01	0.02
CT:HARTFORD	9	0.4	0.1	0.2	0.03	0.01	0.01
DE:WILMINGTON	9	0.4	0.0	0.2	0.01	0.01	0.01
FL:JACKSONVILLE	9	0.1	0.0	0.0	0.01	0.00	0.01
FL:MIAMI	9	0.1	0.0	0.0	0.01	0.00	0.01
HI:HONOLULU	8	0.2	0.1	0.2	0.00	0.00	0.00
IA:IOWA CITY	9	0.8	0.0	0.3	0.02	0.01	0.01
ID:BOISE	8	0.9	0.2	0.5	0.03	0.01	0.02
ID:IDAHO FALLS	9	0.0	0.0	0.0	0.03	0.01	0.02
IL:CHICAGO	9	0.6	0.1	0.3	0.02	0.00	0.01
IN:INDIANAPOLIS	9	0.7	0.1	0.3	0.02	0.01	0.01
KS:TOPEKA	8	1.8	0.6	1.3	0.02	0.01	0.01
KY:FRANKFORT	4	0.6	0.1	0.3	0.01	0.01	0.01
LA:NEW ORLEANS	6	0.1	0.0	0.0	0.01	0.00	0.01
MA:LAWRENCE	4	0.2	0.1	0.1	0.01	0.01	0.01
ME:AUGUSTA	7	0.3	0.1	0.2	0.01	0.00	0.01
MI:LANSING	9	0.3	0.1	0.2	0.02	0.00	0.01
MN:MINNEAPOLIS	9	0.6	0.2	0.3	0.03	0.01	0.01
MO:JEFFERSON CITY	8	2.7	0.2	1.1	0.08	0.01	0.03
MS:JACKSON	8	0.5	0.2	0.3	0.01	0.01	0.01
NC:CHARLOTTE	8	0.4	0.0	0.2	0.01	0.01	0.01
NC:WILMINGTON	8	0.0	0.0	0.0	0.01	0.01	0.01
ND:BISMARCK	5	1.5	0.2	1.0	0.02	0.01	0.01
NE:LINCOLN	8	2.2	0.0	1.2	0.02	0.01	0.01
NH:CONCORD	9	0.3	0.1	0.2	0.01	0.00	0.01
NJ:TRENTON	9	1.3	0.2	0.6	0.01	0.00	0.01
NM:SANTA FE	8	0.2	0.1	0.2	0.02	0.01	0.01
NV:LAS VEGAS	9	0.4	0.1	0.2	0.07	0.01	0.03
NY:ALBANY	4	0.1	0.0	0.1	0.01	0.01	0.01
NY:NEW YORK CITY	9	0.4	0.1	0.2	0.01	0.00	0.01
NY:NIAGARA FALLS	9	0.4	0.1	0.3	0.02	0.00	0.01
NY:SYRACUSE	5	0.2	0.1	0.1	0.01	0.01	0.01

Table 4 (continued)

Airborne Particulates
Gross Beta Concentrations

September 1988

Location	Number of Samples	5-Hour Field Estimate (pCi/m³)			EERF Lab Measurment (pCi/m³)		
		Max	Min	Avg	Max	Min	Avg
NY:YAPHANK	7	0.3	0.1	0.2	0.01	0.00	0.01
OH:COLUMBUS	7	0.2	0.1	0.2	0.02	0.01	0.01
OH:PAINESVILLE	9	0.5	0.0	0.2	0.02	0.01	0.01
OH:TOLEDO	8	0.6	0.0	0.3	0.02	0.01	0.01
OK:OKLAHOMA CITY	9	1.0	0.2	0.6	0.03	0.01	0.01
OR:PORTLAND	9	0.0	0.0	0.0	0.01	0.00	0.01
PA:GOLDSBORO	9	0.9	0.1	0.3	0.01	0.01	0.01
PA:HARRISBURG	9	0.4	0.0	0.2	0.01	0.00	0.01
PA:PITTSBURGH	9	0.3	0.3	0.3	0.03	0.01	0.01
PA:THREE MILE ISLAND	9	0.9	0.2	0.5	0.02	0.01	0.01
RI:PROVIDENCE	9	0.4	0.1	0.2	0.03	0.01	0.01
SC:BARNWELL	1	0.0	0.0	0.0	0.01	0.01	0.01
SC:COLUMBIA	9	0.4	0.1	0.2	0.02	0.01	0.02
SD:PIERRE	9	1.0	0.3	0.7	0.06	0.01	0.02
TN:KNOXVILLE	9	0.5	0.1	0.3	0.02	0.01	0.01
TN:NASHVILLE	8	0.7	0.1	0.3	0.02	0.01	0.01
TX:AUSTIN	7	0.7	0.1	0.3	0.02	0.01	0.02
TX:EL PASO	9	1.1	0.2	0.7	0.03	0.01	0.02
UT:SALT LAKE CITY	8	1.1	0.2	0.4	0.03	0.01	0.02
VA:LYNCHBURG	9	1.4	0.1	0.7	0.01	0.01	0.01
WA:OLYMPIA	9	0.2	0.1	0.1	0.01	0.00	0.01
WA:SPOKANE	5	0.7	0.3	0.4	0.02	0.01	0.01
WI:MADISON	9	1.0	0.2	0.5	0.02	0.01	0.01
WV:CHARLESTON	9	0.6	0.0	0.2	0.02	0.01	0.01

Minimum Detectable Limit for field estimates - 0.1 pCi/m³.
Minimum Detectable Limit for laboratory measurement - 0.01 pCi/m³.

Table 5

Gross Beta Concentrations in Precipitation

July 1988

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m^2)		Specific Gamma Activity
AL:MONTGOMERY	176.6	0.13	0.07	ND
AR:LITTLE ROCK	135.0	0.13	0.05	ND
CO:DENVER	38.0	0.05	0.02	ND
CT:HARTFORD	95.0	0.31	0.06	ND
DE:WILMINGTON	74.0	0.26	0.05	ND
FL:JACKSONVILLE	87.4	0.03	0.03	ND
FL:MIAMI	217.4	0.09	0.09	ND
IL:CHICAGO	107.6	0.04	0.04	ND
LA:NEW ORLEANS	43.0	0.03	0.02	ND
MA:LAWRENCE	131.0	0.21	0.07	ND
ME:AUGUSTA	106.0	0.32	0.06	ND
MI:LANSING	71.0	0.05	0.03	ND
MN:MINNEAPOLIS	41.0	0.05	0.02	ND
MO:JEFFERSON CITY	91.0	0.03	0.04	ND
MS:JACKSON	26.0	0.02	0.01	ND
NC:CHARLOTTE	88.0	0.23	0.05	ND
NC:WILMINGTON	147.0	0.47	0.09	ND
ND:BISMARCK	15.4	0.02	0.01	ND
NH:CONCORD	179.0	0.27	0.09	ND
NJ:TRENTON	110.0	0.18	0.05	ND
NY:ALBANY	50.6	0.05	0.02	ND
NY:NEW YORK CITY	40.8	0.05	0.02	ND
NY:NIAGARA FALLS	189.0	0.07	0.08	ND
NY:SYRACUSE	40.0	0.06	0.02	ND
NY:YAPHANK	61.0	0.11	0.03	ND
OH:COLUMBUS	113.0	0.08	0.05	ND
OH:PAINESVILLE	66.0	0.11	0.03	ND
OH:TOLEDO	50.0	0.05	0.02	ND
OR:PORTLAND	6.0	0.00	0.00	ND
PA:HARRISBURG	110.0	0.25	0.06	ND
PA:MIDDLETOWN	7.0	0.01	0.00	ND
RI:PROVIDENCE	8.0	0.01	0.00	ND
SC:COLUMBIA	81.4	0.12	0.04	ND
SD:PIERRE	42.0	0.05	0.02	ND
TN:KNOXVILLE	84.0	0.00	0.00	ND
TN:NASHVILLE	48.4	0.05	0.02	ND
TX:AUSTIN	60.0	0.02	0.02	ND

Table 5 (continued)

Gross Beta Concentrations in Precipitation

July 1988

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m^2)		Specific Gamma Activity
TX:EL PASO	14.0	0.01	0.01	ND
VA:LYNCHBURG	24.4	0.11	0.02	ND
WA:OLYMPIA	14.4	0.01	0.01	ND
WI:MADISON	63.4	0.02	0.03	ND
WV:CHARLESTON	36.6	0.04	0.02	ND

σ = Sigma Counting Error.
NA = Not Analyzed.
ND = No Gamma Activity Detectable.

Table 6

Gross Beta Concentrations in Precipitation

August 1988

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m^2)		Specific Gamma Activity
AL:MONTGOMERY	57.0	0.21	0.04	ND
AR:LITTLE ROCK	56.6	0.07	0.03	ND
AZ:PHOENIX	14.0	0.02	0.01	ND
CO:DENVER	25.8	0.02	0.01	ND
CT:HARTFORD	74.0	0.17	0.05	ND
DE:WILMINGTON	33.0	0.07	0.02	ND
FL:JACKSONVILLE	179.2	0.08	0.08	ND
FL:MIAMI	162.2	0.06	0.07	ND
IL:CHICAGO	137.8	0.07	0.06	ND
LA:NEW ORLEANS	135.6	0.02	0.05	ND
MA:LAWRENCE	37.0	0.09	0.02	ND
ME:AUGUSTA	137.6	0.71	0.11	ND
MI:LANSING	106.6	0.08	0.04	ND
MN:MINNEAPOLIS	107.2	0.05	0.05	ND
MO:JEFFERSON CITY	80.0	0.15	0.04	ND
MS:JACKSON	119.0	0.12	0.06	ND
NC:CHARLOTTE	138.6	0.22	0.07	ND
NC:WILMINGTON	131.8	0.14	0.07	ND
ND:BISMARCK	33.8	0.06	0.02	ND
NH:CONCORD	128.4	0.34	0.08	ND
NJ:TRENTON	43.0	0.15	0.03	ND
NM:SANTA FE	47.0	0.02	0.02	ND
NV:LAS VEGAS	14.0	0.05	0.01	ND
NY:ALBANY	39.2	0.10	0.02	ND
NY:NEW YORK CITY	41.4	0.02	0.02	ND
NY:NIAGARA FALLS	15.0	0.01	0.01	ND
NY:SYRACUSE	32.0	0.13	0.02	ND
NY:YAPHANK	52.0	0.09	0.03	ND
OH:COLUMBUS	19.4	0.11	0.02	ND
OH:PAINESVILLE	117.0	0.16	0.06	ND
OH:TOLEDO	90.0	0.09	0.04	ND
PA:HARRISBURG	96.0	0.16	0.05	ND
PA:MIDDLETOWN	6.0	0.01	0.00	ND
PA:PITTSBURGH	16.6	0.09	0.01	ND
RI:PROVIDENCE	7.0	0.01	0.00	ND
SC:BARNWELL	7.4	0.01	0.00	ND
SC:COLUMBIA	113.6	0.05	0.05	ND

Table 6 (continued)

Gross Beta Concentrations in Precipitation

August 1988

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m^2)		Specific Gamma Activity
SD:PIERRE	45.0	0.04	0.03	ND
TN:KNOXVILLE	48.0	0.04	0.02	ND
TN:NASHVILLE	75.2	0.06	0.03	ND
TX:AUSTIN	16.0	0.01	0.01	ND
TX:EL PASO	13.0	0.00	0.01	ND
UT:SALT LAKE CITY	5.0	0.07	0.01	ND
VA:LYNCHBURG	77.2	0.35	0.05	ND
WA:OLYMPIA	7.0	0.00	0.00	ND
WI:MADISON	39.6	0.02	0.02	ND
WV:CHARLESTON	100.4	0.11	0.05	ND

σ = Sigma Counting Error.
NA = Not Analyzed.
ND = No Gamma Activity Detectable.

Table 7

Gross Beta Concentrations in Precipitation

September 1988

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m^2)		Specific Gamma Activity
AL:MONTGOMERY	160.4	0.16	0.08	ND
AR:LITTLE ROCK	16.0	0.02	0.01	ND
CO:DENVER	24.0	0.02	0.01	ND
CT:HARTFORD	39.0	0.07	0.02	ND
DE:WILMINGTON	68.0	0.07	0.03	ND
FL:JACKSONVILLE	260.2	0.08	0.10	ND
FL:MIAMI	51.2	0.05	0.02	ND
ID:BOISE	4.0	0.01	0.00	ND
IL:CHICAGO	2.2	0.00	0.00	ND
LA:NEW ORLEANS	106.0	0.11	0.06	ND
MA:LAWRENCE	41.0	0.07	0.02	ND
ME:AUGUSTA	19.0	0.10	0.02	ND
MI:LANSING	153.2	0.16	0.07	ND
MN:MINNEAPOLIS	82.0	0.12	0.04	ND
MO:JEFFERSON CITY	34.0	0.02	0.01	ND
NC:CHARLOTTE	123.0	0.05	0.05	ND
NC:WILMINGTON	156.8	0.09	0.07	ND
ND:BISMARCK	14.0	0.03	0.01	ND
NH:CONCORD	44.0	0.09	0.02	ND
NJ:TRENTON	56.6	0.13	0.03	ND
NM:SANTA FE	18.0	0.02	0.01	ND
NY:ALBANY	83.2	0.07	0.04	ND
NY:NEW YORK CITY	20.0	0.01	0.01	ND
NY:NIAGARA FALLS	46.0	0.04	0.02	ND
NY:SYRACUSE	32.0	0.02	0.01	ND
NY:YAPHANK	78.0	0.08	0.04	ND
OH:COLUMBUS	43.0	0.04	0.02	ND
OH:PAINESVILLE	62.0	0.10	0.03	ND
OH:TOLEDO	48.0	0.03	0.02	ND
OK:OKLAHOMA CITY	45.0	0.04	0.02	ND
PA:HARRISBURG	89.4	0.08	0.04	ND
PA:MIDDLETOWN	60.0	0.06	0.03	ND
PA:PITTSBURGH	40.6	0.10	0.02	ND
SC:BARNWELL	7.4	0.01	0.00	ND
SC:COLUMBIA	162.0	0.05	0.08	ND
TN:KNOXVILLE	79.0	0.05	0.03	ND
TN:NASHVILLE	96.4	0.01	0.04	ND

Table 7 (continued)

Gross Beta Concentrations in Precipitation

September 1988

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m^2)		Specific Gamma Activity
TX:EL PASO	23.8	0.03	0.01	ND
UT:SALT LAKE CITY	1.8	0.02	0.00	ND
VA:LYNCHBURG	76.0	0.23	0.05	ND
WA:OLYMPIA	57.0	0.02	0.02	ND
WI:MADISON	85.0	0.07	0.04	ND
WV:CHARLESTON	61.0	0.07	0.03	ND

σ = Sigma Counting Error.
NA = Not Analyzed.
ND = No Gamma Activity Detectable.

Table 8

Precipitation
Tritium Concentrations

July - September 1988

Location	July 1988 nCi/l	July 1988 ±2σ	August 1988 nCi/l	August 1988 ±2σ	September 1988 nCi/l	September 1988 ±2σ
AL:MONTGOMERY	0.2	0.2	0.2	0.2	0.2	0.2
AR:LITTLE ROCK	0.2	0.2	0.3	0.2	0.2	0.2
AZ:PHOENIX	NS		0.1	0.2	NS	
CO:DENVER	0.2	0.2	0.2	0.2	0.3	0.2
CT:HARTFORD	0.1	0.2	0.4	0.2	0.2	0.2
DE:WILMINGTON	0.2	0.2	0.3	0.2	0.3	0.2
FL:JACKSONVILLE	0.1	0.2	0.1	0.2	0.2	0.2
FL:MIAMI	0.1	0.2	0.1	0.2	0.2	0.2
ID:BOISE	NS		NS		0.1	0.2
IL:CHICAGO	0.1	0.2	0.2	0.2	0.2	0.2
LA:NEW ORLEANS	0.1	0.2	0.1	0.2	0.2	0.2
MA:LAWRENCE	0.1	0.2	0.1	0.2	0.2	0.2
ME:AUGUSTA	0.1	0.2	0.2	0.2	0.3	0.2
MI:LANSING	0.2	0.2	0.2	0.2	0.1	0.2
MN:MINNEAPOLIS	0.1	0.2	0.1	0.2	0.2	0.2
MO:JEFFERSON CITY	0.1	0.2	0.1	0.2	0.2	0.2
MS:JACKSON	0.2	0.2	0.2	0.2	NS	
NC:CHARLOTTE	0.3	0.2	0.1	0.2	0.1	0.2
NC:WILMINGTON	0.2	0.2	0.2	0.2	0.3	0.2
ND:BISMARCK	0.2	0.2	0.2	0.2	0.3	0.2
NH:CONCORD	0.2	0.2	0.1	0.2	0.1	0.2
NJ:TRENTON	0.1	0.2	0.2	0.2	0.1	0.2
NM:SANTA FE	NS		0.2	0.2	0.2	0.2
NV:LAS VEGAS	NS		0.2	0.2	NS	
NY:ALBANY	0.2	0.2	0.2	0.2	0.2	0.2
NY:NEW YORK CITY	0.1	0.2	0.1	0.2	0.2	0.2
NY:NIAGARA FALLS	0.2	0.2	0.2	0.2	0.3	0.2
NY:SYRACUSE	0.2	0.2	0.2	0.2	0.2	0.2
NY:YAPHANK	0.2	0.2	0.2	0.2	0.2	0.2
OH:COLUMBUS	0.1	0.2	0.2	0.2	0.3	0.2
OH:PAINESVILLE	0.2	0.2	0.1	0.2	0.1	0.2
OH:TOLEDO	0.2	0.2	0.2	0.2	0.2	0.2
OK:OKLAHOMA CITY	NS		NS		0.2	0.2
OR:PORTLAND	0.1	0.2	NS		NS	
PA:HARRISBURG	0.1	0.2	0.3	0.2	0.3	0.2
PA:MIDDLETOWN	0.1	0.2	0.1	0.2	0.4	0.2
PA:PITTSBURGH	NS		0.1	0.2	0.2	0.2

Table 8 (continued)

Precipitation
Tritium Concentrations
July - September 1988

Location	July 1988 nCi/l	±2σ	August 1988 nCi/l	±2σ	September 1988 nCi/l	±2σ
RI:PROVIDENCE	0.2	0.2	0.1	0.2	NS	
SC:BARNWELL	NS		0.9	0.2	0.5	0.2
SC:COLUMBIA	0.6	0.2	0.1	0.2	0.1	0.2
SD:PIERRE	0.1	0.2	0.1	0.2	NS	
TN:KNOXVILLE	0.1	0.2	0.3	0.2	0.1	0.2
TN:NASHVILLE	0.1	0.2	0.2	0.2	0.2	0.2
TX:AUSTIN	0.2	0.2	0.1	0.2	NS	
TX:EL PASO	0.2	0.2	0.3	0.2	0.2	0.2
UT:SALT LAKE CITY	NS		0.2	0.2	0.2	0.2
VA:LYNCHBURG	0.3	0.2	0.2	0.2	0.1	0.2
WA:OLYMPIA	0.1	0.2	0.2	0.2	0.3	0.2
WI:MADISON	0.2	0.2	0.3	0.2	0.2	0.2
WV:CHARLESTON	0.1	0.2	0.2	0.2	0.3	0.2

σ = Sigma Counting Error.
NS = No Sample.

Plutonium and Uranium in Airborne Particulates

Environmental radiation levels of plutonium and uranium are determined by the analysis of semi-annually composited samples (air filters) collected from the continuously operating airborne particulate samplers.

Concentration of the specific isotopes of plutonium -238, -239, and -240 and uranium-234, -235, and -238 are determined by alpha spectroscopy following chemical separation. The volume of air represented by the semiannual composite ranges from 25,000 to 40,000 cubic meters.

Plutonium and uranium results are published when they become available.

Table 9 contains the plutonium and uranium in precipitation data for January - December 1987.

Table 9

Plutonium and Uranium Analyses
Selected Precipitation Composite Samples

January - December 1987

Location	^{238}Pu		$^{239-240}Pu$		^{234}U		^{235}U		^{238}U	
	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$
AL:MONTGOMERY	-.001	0.020	0.004	0.010	0.364	0.115	0.005	0.006	0.029	0.014
AR:LITTLE ROCK	0.017	0.016	0.001	0.008	0.062	0.021	0.006	0.006	0.040	0.017
CA:BERKELEY	0.016	0.015	-0.003	0.006	0.121	0.048	0.008	0.014	0.050	0.027
CT:HARTFORD	0.020	0.013	0.000	0.006	0.069	0.028	0.013	0.012	0.069	0.029
DE:WILMINGTON	0.018	0.018	0.002	0.010	0.049	0.019	-0.002	0.003	0.031	0.015
FL:JACKSONVILLE	0.013	0.017	-0.004	0.017	0.029	0.017	0.001	0.006	0.011	0.009
FL:MIAMI	0.011	0.017	-0.003	0.013	0.025	0.016	0.002	0.005	0.030	0.017
ID:BOISE	0.003	0.012	0.004	0.006	0.051	0.018	0.010	0.008	0.023	0.012
ID:IDAHO FALLS	0.006	0.008	0.002	0.004	0.031	0.014	-0.001	0.003	0.012	0.009
IL:CHICAGO	0.002	0.021	0.000	0.000	0.011	0.010	0.007	0.008	0.021	0.015
LA:NEW ORLEANS	0.003	0.012	0.002	0.003	0.033	0.015	0.000	0.000	0.024	0.013
MA:LAWRENCE	0.026	0.023	0.002	0.005	0.077	0.025	0.001	0.003	0.040	0.018
ME:AUGUSTA	0.008	0.013	0.005	0.006	0.055	0.026	-0.004	0.007	0.026	0.017
MI:LANSING	0.017	0.011	0.003	0.005	0.035	0.018	0.004	0.009	0.019	0.013
MN:MINNEAPOLIS	0.014	0.011	0.001	0.002	0.032	0.013	0.001	0.002	0.022	0.012
MO:JEFFERSON CITY	0.002	0.011	0.000	0.000	0.013	0.021	0.000	0.000	0.023	0.017
MS:JACKSON	-.007	0.014	0.012	0.009	0.028	0.010	0.004	0.005	0.022	0.008
NC:CHARLOTTE	0.005	0.005	0.005	0.005	0.022	0.011	0.002	0.005	0.009	0.008
NC:WILMINGTON	0.007	0.007	-0.001	0.005	0.035	0.018	0.001	0.006	0.011	0.009
ND:BISMARCK	0.003	0.005	0.003	0.005	0.062	0.021	0.003	0.006	0.014	0.010
NH:CONCORD	0.019	0.014	0.002	0.005	0.019	0.010	0.000	0.000	0.019	0.010
NJ:TRENTON	0.006	0.009	0.002	0.003	0.004	0.005	0.007	0.007	0.018	0.011
NM:SANTA FE	0.015	0.011	0.000	0.004	0.037	0.023	0.005	0.008	0.016	0.015
NV:LAS VEGAS	0.000	0.029	0.005	0.008	0.087	0.042	0.003	0.013	0.044	0.026
NY:ALBANY	0.020	0.017	0.001	0.005	0.030	0.018	0.003	0.005	0.035	0.016
NY:NEW YORK CITY	0.008	0.013	0.002	0.003	0.023	0.012	0.000	0.000	0.011	0.008
NY:NIAGARA FALLS	0.012	0.014	-0.001	0.004	0.014	0.009	0.010	0.008	0.002	0.004
NY:SYRACUSE	0.025	0.015	0.005	0.008	0.078	0.023	0.007	0.007	0.046	0.018
NY:YAPHANK	0.008	0.026	0.001	0.010	0.061	0.023	0.004	0.006	0.054	0.021
OH:COLUMBUS	0.017	0.010	0.000	0.000	0.023	0.013	0.005	0.006	0.008	0.006
OH:PAINESVILLE	0.005	0.009	0.003	0.006	0.041	0.017	0.008	0.007	0.018	0.011
OH:TOLEDO	0.009	0.012	0.004	0.004	0.026	0.013	0.001	0.002	0.014	0.009
OK:OKLAHOMA CITY	0.017	0.010	0.004	0.004	0.017	0.012	0.000	0.000	0.012	0.009
OR:PORTLAND	0.013	0.009	0.001	0.002	0.025	0.012	0.000	0.000	0.007	0.007
PA:HARRISBURG	-.001	0.009	-0.001	0.004	0.019	0.011	0.000	0.000	0.004	0.005
PA:MIDDLETOWN	0.019	0.013	0.001	0.007	0.057	0.025	0.005	0.010	0.047	0.022
PA:PITTSBURGH	-.004	0.010	0.003	0.010	0.018	0.009	0.002	0.002	0.007	0.005

Table 9 (continued)

Plutonium and Uranium Analyses
Selected Precipitation Composite Samples

January - December 1987

Location	^{238}Pu		$^{239-240}Pu$		^{234}U		^{235}U		^{238}U	
	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$
PA:PITTSBURGH	0.005	0.015	0.011	0.009	0.020	0.015	0.002	0.003	0.008	0.007
RI:PROVIDENCE	0.012	0.024	-0.002	0.010	0.060	0.023	0.011	0.010	0.040	0.018
SC:BARNWELL	0.000	0.011	0.002	0.003	0.026	0.013	0.006	0.006	0.009	0.008
SC:COLUMBIA	0.005	0.034	0.003	0.010	0.021	0.014	0.000	0.000	0.015	0.012
SD:PIERRE	0.001	0.009	0.001	0.003	0.015	0.011	0.000	0.000	0.007	0.009
TN:KNOXVILLE	0.007	0.010	-0.003	0.004	0.027	0.017	0.004	0.007	0.011	0.011
TN:NASHVILLE	0.030	0.014	0.013	0.010	0.031	0.010	0.006	0.005	0.030	0.010
TX:AUSTIN	0.002	0.019	0.000	0.006	0.025	0.013	0.000	0.000	0.012	0.009
VA:LYNCHBURG	0.002	0.008	0.004	0.005	0.030	0.016	0.008	0.007	0.016	0.009
WA:OLYMPIA	0.003	0.012	0.007	0.007	0.051	0.018	0.003	0.004	0.025	0.012
WI:MADISON	0.021	0.015	0.003	0.004	0.061	0.023	0.002	0.004	0.009	0.010
WV:CHARLESTON	0.009	0.009	0.001	0.003	0.016	0.010	0.000	0.000	0.021	0.011

σ = Sigma Counting Error.

Krypton-85

Krypton-85 is a long-lived noble gas with a half-life of 10.8 years. It is released into the atmosphere by nuclear reactor operations, fuel reprocessing, weapons tests, and research and defense related activities. Krypton-85 also occurs naturally in minor quantities primarily from the neutron capture of stable krypton-84 as well as spontaneous fission and neutron-induced fission of uranium. Krypton-85 in the atmosphere has been monitored to identify and establish baseline levels and long-term trends.

Krypton-85 analysis began in January 1973 with sample collections and analyses being performed for 12 sampling locations. These locations were selected to provide atmospheric coverage of the United States with considerations being given to the proximity to fuel reprocessing plants, nuclear reactors, and wide geographic coverage.

Dry compressed air samples, collected at each location, are purchased from commercial air suppliers and shipped to the EERF where the krypton-85 is cryogenically separated and counted in a liquid scintillation system.

The last Kr-85 results were for 1976, 1977, and 1979. They were published in *Environmental Radiation Data: Report 30.*

ENVIRONMENTAL RADIATION AMBIENT MONITORING SYSTEM (ERAMS)

Section II. Water Program

The ERAMS water program provides data on ambient radiation levels in the nation's rivers, streams, and drinking water supplies.

Surface Water

Quarterly grab samples are taken downstream from operating or future nuclear facilities at 58 stations.

Surface water samples are analyzed for tritium quarterly and specific gamma activity annually. Tritium is a primary radioactive pollutant from nuclear power plants and weapons production activities.

Tritium concentrations are determined by liquid scintillation counting of distilled samples. Gamma scans are performed annually to determine levels of gamma emitting radionuclides.

Table 10 contains the data for tritium concentrations for July - September 1988.

Table 10

Surface Water
Tritium Concentrations

July - September 1988

Location	Source	Date Collected	nCi/l	±2σ
AL:DECATUR	TENNESSEE RIVER	07/05/88	0.2	0.2
AL:DOTHAN	CHATTAHOOCHEE RIVER	07/14/88	0.7	0.2
AL:SCOTTSBORO	TENNESSEE RIVER	07/08/88	0.3	0.2
AR:LITTLE ROCK	ARKANSAS RIVER	07/20/88	0.2	0.2
CA:DIABLO CANYON	PACIFIC OCEAN	05/15/88	0.2	0.2
CA:DIABLO CANYON	PACIFIC OCEAN	09/29/88	0.1	0.2
CA:EUREKA	HUMBOLDT BAY	06/30/88	0.1	0.2
CA:SAN ONOFRE	PACIFIC OCEAN	09/15/88	0.1	0.2
CO:PLATTEVILLE	SOUTH PLATTE RIVER	07/05/88	0.2	0.2
CT:EAST HADDAM	CONNECTICUT RIVER	09/19/88	0.3	0.2
CT:WATERFORD	LONG ISLAND SOUND	09/19/88	0.1	0.2
FL:CRYSTAL RIVER	GULF OF MEXICO	07/05/88	0.1	0.2
FL:FT. PIERCE	ATLANTIC OCEAN	07/13/88	0.2	0.2
FL:HOMESTEAD	BISCAYNE BAY	07/25/88	0.1	0.2
IA:CEDAR RAPIDS	CEDAR RIVER	07/05/88	0.2	0.2
ID:BUHL	SNAKE RIVER	07/13/88	0.2	0.2
IL:E. MOLINE	MISSISSIPPI RIVER	08/08/88	0.2	0.2
IL:MORRIS	ILLINOIS RIVER	07/29/88	0.2	0.2
IL:ZION	LAKE MICHIGAN	09/30/88	0.2	0.2
KS:LeROY	NEOSHO RIVER	05/15/88	0.2	0.2
LA:NEW ORLEANS	MISSISSIPPI RIVER	07/29/88	0.2	0.2
MA:PLYMOUTH	CAPE COD BAY	07/05/88	0.2	0.2
MD:CONOWINGO	SUSQUEHANNA RIVER	07/05/88	0.2	0.2
MD:LUSBY	CHESAPEAKE BAY	07/05/88	0.2	0.2
ME:WISCASSET	MONTSEWAY BAY	07/06/88	0.3	0.2
MI:BRIDGMAN	LAKE MICHIGAN	07/19/88	0.3	0.2
MI:CHARLEVOIX	LAKE MICHIGAN	07/15/88	0.1	0.2
MI:MONROE	LAKE ERIE	07/11/88	0.2	0.2
MI:SOUTH HAVEN	LAKE MICHIGAN	07/19/88	0.2	0.2
MN:MONTICELLO	MISSISSIPPI RIVER	07/12/88	0.2	0.2
MN:RED WING	MISSISSIPPI RIVER	07/18/88	0.4	0.2
MS:PORT GIBSON	MISSISSIPPI RIVER	07/14/88	0.1	0.2
NC:CHARLOTTE	CATAWBA RIVER	07/11/88	1.7	0.2
NC:SOUTHPORT	ATLANTIC OCEAN	08/12/88	0.3	0.2
NE:RULO	MISSOURI RIVER	07/27/88	0.3	0.2
NJ:BAYSIDE	DELAWARE RIVER	07/19/88	0.2	0.2
NJ:OYSTER CREEK	OYSTER CREEK	07/14/88	0.1	0.2

Table 10 (continued)

Surface Water
Tritium Concentrations

July - September 1988

Location	Source	Date Collected	nCi/l	$\pm 2\sigma$
NV:BOULDER CITY	COLORADO RIVER	07/06/88	0.3	0.2
NY:CHELSEA	HUDSON RIVER	07/01/88	0.2	0.2
NY:OSSINING	HUDSON RIVER	08/24/88	0.2	0.2
NY:OSWEGO	LAKE ONTARIO	07/22/88	0.4	0.2
OH:TOLEDO	LAKE ERIE	06/29/88	0.2	0.2
OR:BRADWOOD	COLUMBIA RIVER	07/27/88	0.2	0.2
PA:DANVILLE	SUSQUEHANNA RIVER	07/06/88	0.1	0.2
SC:ALLENDALE	SAVANNAH RIVER	07/28/88	2.7	0.2
SC:BROAD RIVER	BROAD RIVER	07/22/88	0.6	0.2
SC:HARTSVILLE	LAKE ROBINSON	07/11/88	2.1	0.2
TN:KINGSTON	CLINCH RIVER	07/18/88	0.4	0.2
TN:OAK RIDGE	CLINCH RIVER	08/15/88	0.4	0.2
TN:OAK RIDGE	CLINCH RIVER	05/15/88	3.5	0.2
TX:EL PASO	RIO GRANDE	07/25/88	0.2	0.2
TX:MATAGORDA	COLORADO RIVER	07/20/88	0.2	0.2
VA:DOSWELL	NORTH ANNA RIVER	07/14/88	3.6	0.2
VA:NEWPORT NEWS	JAMES RIVER	07/14/88	0.1	0.2
WA:NORTHPORT	COLUMBIA RIVER	07/19/88	0.1	0.2
WA:RICHLAND	COLUMBIA RIVER	07/12/88	0.1	0.2
WI:TWO CREEKS	LAKE MICHIGAN	07/11/88	0.2	0.2
WI:VICTORY	MISSISSIPPI RIVER	07/11/88	0.1	0.2
WV:WHEELING	OHIO RIVER	09/19/88	0.3	0.2

σ = Sigma Counting Error.

Drinking Water

This program monitors ambient radiation levels in drinking water at 78 sites. These data serve to assess trends and anomalies in concentrations, and to compare with standards set forth in the EPA "National Interim Primary Drinking Water Regulations." These regulations provide for approval of supplies when the combined radium-226 and radium-228 levels do not exceed 5 pCi/l, when the gross alpha (excluding radon and uranium) levels do not exceed 15 pCi/l, when tritium levels do not exceed 20,000 pCi/l, when the strontium-90 levels do not exceed 8 pCi/l, and when the gross beta levels do not exceed 50 pCi/l.

Grab samples are taken at the 78 sites which are either major population centers or selected nuclear facility environs.

The analyses include (a) tritium on a quarterly basis; (b) gross alpha, gross beta, strontium-90, and gamma on annual composites; (c) radium-226 if the gross alpha exceeds 2 pCi/l and radium-228 if the radium-226 falls between 3 and 5 pCi/l; (d) specific iodine-131 on one quarterly sample per year for each station; and (e) an annual composite for plutonium-238, -239, and -240 and uranium-234, -235, and -238 for stations that demonstrate gross alpha levels greater than 2 pCi/l.

Tritium analyses are performed by scintillation counting of the distilled samples. Gross beta and alpha are determined by evaporating an aliquot on a stainless steel planchet for counting. Radium-226 is determined by the standard emanation technique. Strontium-90 is determined by beta counting a strontium carbonate precipitate isolated by ion exchange.

Table 11 contains the data in drinking water for July - September 1988.

Table 11

Drinking Water
Tritium Concentrations

July - September 1988

Location	Date Collected	nCi/l	$\pm 2\sigma$
AK:FAIRBANKS	07/11/88	0.3	0.2
AL:DOTHAN	07/14/88	0.1	0.2
AL:MONTGOMERY	07/05/88	0.1	0.2
AL:MUSCLE SHOALS	07/07/88	0.2	0.2
AL:SCOTTSBORO	07/08/88	0.3	0.2
AR:LITTLE ROCK	07/19/88	0.2	0.2
CA:BERKELEY	07/08/88	0.2	0.2
CA:LOS ANGELES	07/07/88	0.2	0.2
CO:DENVER	07/06/88	0.1	0.2
CO:PLATTEVILLE	07/05/88	0.2	0.2
CT:HARTFORD	07/01/88	0.1	0.2
DC:WASHINGTON	07/08/88	0.2	0.2
DE:DOVER	09/28/88	0.1	0.2
FL:MIAMI	07/01/88	0.2	0.2
FL:TAMPA	07/12/88	0.1	0.2
GA:SAVANNAH	07/22/88	2.3	0.2
HI:HONOLULU	07/26/88	0.2	0.2
IA:CEDAR RAPIDS	07/05/88	0.2	0.2
ID:BOISE	07/01/88	0.1	0.2
ID:IDAHO FALLS	07/06/88	0.2	0.2
IL:MORRIS	07/05/88	0.1	0.2
IL:W. CHICAGO	07/05/88	0.2	0.2
KS:TOPEKA	07/01/88	0.1	0.2
LA:NEW ORLEANS	07/11/88	0.2	0.2
MA:LAWRENCE	07/06/88	0.2	0.2
MD:BALTIMORE	09/06/88	0.4	0.2
MD:CONOWINGO	07/05/88	0.2	0.2
ME:AUGUSTA	07/05/88	0.1	0.2
MI:DETROIT	07/11/88	0.3	0.2
MI:GRAND RAPIDS	07/11/88	0.2	0.2
MN:MINNEAPOLIS	07/05/88	0.2	0.2
MN:RED WING	07/13/88	0.2	0.2
MS:JACKSON	07/14/88	0.1	0.2
MS:PORT GIBSON	08/14/88	0.3	0.2
MT:HELENA	07/07/88	0.3	0.2
NC:CHARLOTTE	07/11/88	1.0	0.2
NC:WILMINGTON	08/12/88	0.1	0.2
ND:BISMARCK	07/01/88	0.2	0.2

Table 11 (continued)

Drinking Water
Tritium Concentrations
July - September 1988

Location	Date Collected	nCi/l	$\pm 2\sigma$
NE:LINCOLN	07/28/88	0.1	0.2
NH:CONCORD	07/01/88	0.2	0.2
NJ:TRENTON	07/01/88	0.2	0.2
NJ:WARETOWN	07/21/88	0.2	0.2
NV:LAS VEGAS	07/06/88	0.1	0.2
NY:ALBANY	07/07/88	0.3	0.2
NY:NEW YORK CITY	07/20/88	0.2	0.2
NY:NIAGARA FALLS	07/05/88	0.2	0.2
OH:CINCINNATI	06/23/88	0.2	0.2
OH:COLUMBUS	08/01/88	0.2	0.2
OH:EAST LIVERPOOL	07/06/88	0.2	0.2
OH:PAINESVILLE	07/01/88	0.2	0.2
OH:TOLEDO	06/28/88	0.2	0.2
OK:OKLAHOMA CITY	07/14/88	0.2	0.2
OR:PORTLAND	07/15/88	0.2	0.2
PA:COLUMBIA	07/05/88	0.2	0.2
PA:HARRISBURG	07/01/88	0.1	0.2
PA:PITTSBURGH	07/07/88	0.3	0.2
PC:ANCON	07/15/88	0.2	0.2
RI:PROVIDENCE	07/05/88	0.2	0.2
SC:BARNWELL	07/06/88	0.1	0.2
SC:COLUMBIA	07/01/88	0.5	0.2
SC:HARTSVILLE	07/11/88	0.2	0.2
SC:JENKINSVILLE	07/05/88	0.2	0.2
SC:SENECA	07/13/88	0.2	0.2
TN:CHATTANOOGA	07/22/88	0.3	0.2
TN:KNOXVILLE	07/01/88	0.3	0.2
TX:AUSTIN	07/18/88	0.1	0.2
VA:DOSWELL	08/18/88	0.1	0.2
VA:LYNCHBURG	07/01/88	0.3	0.2
VA:VIRGINIA BEACH	07/11/88	0.1	0.2
VI:ST. THOMAS	07/18/88	0.2	0.2
WA:RICHLAND	07/12/88	0.2	0.2
WA:SEATTLE	07/01/88	0.1	0.2
WI:GENOA CITY	07/11/88	0.1	0.2
WI:MADISON	07/18/88	0.2	0.2

σ = Sigma Counting Error.

ENVIRONMENTAL RADIATION AMBIENT MONITORING SYSTEM (ERAMS)

Section III. External Gamma Ambient Monitoring Program

The external gamma monitoring program, which began in October 1978, provides a continuous measurement of ambient gamma exposure rates, including cosmic, at selected sites throughout the continental United States. Data from this program are used to evaluate fluctuations in natural background due to variations in environmental conditions and to provide a means of monitoring any significant increases in ambient gamma levels. The program consists of approximately 22 sites representing wide geographic coverage throughout the country.[1] Although exposure measurements at these few sites are not totally representative of nationwide exposures, they do indicate national trends.

The monitoring program utilizes CaF_2:Mn thermoluminescent dosimeters (TLD's). These dosimeters are commercially available glass-bulb type dosimeters with energy compensating shields. A group of three TLD's is located at each station or site. Dosimeters are annealed by the station operator prior to positioning in the field. The dosimeters are returned to EERF for readout approximately every three months. Several dosimeters are annealed by the station operator as controls and returned with the exposed field dosimeters to correct for any exposures accumulated during shipment.

Table 12 contains the data for environmental gamma ambient monitoring program July - September 1988.

[1] Some of these sites may not return dosimeters each period and consequently the number of sites listed may vary slightly.

Table 12

Environmental Gamma Ambient Monitoring Program

July - September 1988

Location	Date Range	Integrated Exposure mR	Exposure Rate μR/hr	$\pm 2\sigma$
AL:MONTGOMERY	07/01/88-10/03/88	19.7	8.7	5.4
CA:BERKELEY	07/06/88-10/04/88	12.6	5.8	8.5
CO:DENVER	07/06/88-09/30/88	32.7	15.9	5.9
FL:ORLANDO	06/30/88-09/30/88	14.9	6.7	6.8
ID:BOISE	06/28/88-10/03/88	27.8	11.9	7.0
IL:CHICAGO	06/29/88-10/03/88	21.9	9.5	6.5
ND:BISMARCK	07/01/88-09/30/88	24.1	11.0	3.9
NJ:TRENTON	06/30/88-10/11/88	34.7	14.1	7.1
NM:SANTA FE	07/05/88-10/07/88	32.9	14.6	3.7
NV:LAS VEGAS	06/30/88-09/30/88	17.4	7.9	6.0
NY:NEW YORK	07/25/88-10/13/88	20.6	10.7	7.1
OH:COLUMBUS	08/01/88-11/15/88	22.8	9.0	9.2
OK:OKLAHOMA CITY	06/28/88-10/04/88	22.1	9.4	3.7
OR:PORTLAND	06/30/88-09/30/88	19.9	9.0	7.3
PA:HARRISBURG	07/08/88-10/03/88	15.1	7.2	4.8
PA:PITTSBURGH	07/05/88-10/05/88	29.5	13.4	8.8
RI:PROVIDENCE	07/05/88-09/30/88	23.0	11.0	6.5
SC:BARNWELL	06/30/88-10/06/88	20.9	8.9	6.2
SC:COLUMBIA	06/28/88-09/30/88	27.8	12.3	4.9
TN:KNOXVILLE	06/29/88-10/03/88	26.6	11.5	10.0
VA:RICHMOND	06/30/88-09/30/88	18.5	8.4	4.8
VT:MONTPELIER	07/13/88-11/07/88	22.1	7.9	7.0

σ = Sigma Counting Error (in percent).

ENVIRONMENTAL RADIATION
AMBIENT MONITORING SYSTEM (ERAMS)

Section IV. Milk Program

Pasteurized Milk

This is a cooperative program with the Dairy and Lipid Products Branch, Milk Sanitation Section, Food and Drug Administration. Milk is a reliable indicator of the general population's intake of radionuclides since it is consumed fresh by a large segment of the population and can contain several of the biologically important radionuclides that result from environmental releases from nuclear activities. A primary function of this program is to obtain reliable monitoring data relative to current radionuclide concentrations and determine any long-term trends.

Monthly samples are collected at 65 sampling sites with one or more located in each state, Puerto Rico, and the Panama Canal Zone. The samples are composited, according to production, from the major milk suppliers representing more than 80 percent of the milk consumed in a given population center.

The samples are analyzed for gamma emitting nuclides, which include iodine-131, barium-140, cesium-137, and potassium. All samples collected in July are analyzed for strontium-89 and strontium-90. Also, for the first month of the three quarters beginning January, April and October, 10 regional composite samples of milk made up from the states within each of EPA's 10 regions are analyzed for strontium-89 and strontium-90.

Iodine-131, barium-140, cesium-137, and potassium are determined by gamma spectral analysis. Strontium-89 and strontium-90 are determined by beta counting a total strontium precipitate that has been chemically separated by ion exchange.

Tables 13-15 contain the concentrations of radionuclides in pasteurized milk for July - September 1988. Table 16 contains the concentrations of strontium-90 and strontium-89 in pasteurized milk EPA Location Composites for July - September 1988.

Table 13

Concentrations of Radionuclides in Pasteurized Milk

July 1988

Location	Date Collected	K		^{137}Cs		^{140}Ba		^{131}I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
AL:MONTGOMERY	07/08/88	1.65	0.13	3	7	-2	8	1	7
AR:LITTLE ROCK	07/05/88	1.54	0.08	-1	5	-8	6	-2	5
AZ:PHOENIX	07/07/88	1.47	0.13	-3	9	-3	9	4	7
CA:LOS ANGELES	07/05/88	1.62	0.09	1	5	-1	6	-5	5
CA:SACRAMENTO	07/05/88	1.52	0.13	6	9	-9	9	-1	7
CA:SAN FRANCISCO	07/06/88	1.68	0.13	-3	7	-2	8	6	7
CO:DENVER	07/30/88	1.39	0.13	3	9	-3	9	5	7
CT:HARTFORD	07/11/88	1.37	0.13	6	9	-5	9	2	7
DC:WASHINGTON	07/08/88	1.36	0.13	4	9	-7	9	2	7
DE:WILMINGTON	07/06/88	1.50	0.12	4	7	-6	8	-3	7
FL:TAMPA	07/05/88	1.60	0.13	4	7	-2	8	6	7
GA:ATLANTA	07/13/88	1.57	0.12	2	7	-5	8	3	7
HI:HONOLULU	07/11/88	1.79	0.13	3	7	-9	8	5	7
IA:DES MOINES	07/06/88	1.38	0.13	5	9	-1	9	4	7
IL:CHICAGO	07/05/88	1.44	0.13	7	9	2	9	1	7
IN:INDIANAPOLIS	07/06/88	1.60	0.13	1	7	-7	8	5	7
KS:WICHITA	07/07/88	1.32	0.08	2	6	-3	6	4	5
KY:LOUISVILLE	07/05/88	1.32	0.12	3	9	-3	9	5	7
LA:NEW ORLEANS	07/01/88	1.66	0.13	3	7	-4	8	2	7
MA:BOSTON	07/13/88	1.54	0.09	-1	5	-4	6	-4	5
MD:BALTIMORE	07/01/88	1.43	0.13	10	9	-9	9	0	7
ME:PORTLAND	07/08/88	1.48	0.13	7	9	-4	9	5	7
MI:DETROIT	07/11/88	1.72	0.13	5	7	-1	8	2	7
MI:GRAND RAPIDS	07/05/88	1.59	0.13	5	7	0	8	-7	7
MN:MINNEAPOLIS	07/11/88	1.45	0.13	-1	9	-4	9	-1	7
MN:ST. PAUL	07/05/88	1.39	0.13	5	9	-5	9	6	7
MO:KANSAS CITY	07/15/88	1.35	0.12	1	9	-4	9	0	7
MO:ST. LOUIS	07/05/88	1.52	0.12	-5	7	-3	8	-6	7
MS:JACKSON	07/11/88	1.37	0.13	5	9	-1	9	-4	7
MT:HELENA	07/12/88	1.40	0.13	0	9	-3	9	0	7
NC:CHARLOTTE	07/1[illegible]/88	1.64	0.16	8	10	-9	13	3	11
ND:MINOT	07/26/88	1.36	0.12	9	9	-8	9	6	7
NE:OMAHA	07/09/88	1.52	0.12	0	7	-4	8	-5	7
NJ:TRENTON	07/06/88	1.63	0.13	-1	7	-3	8	-2	7
NM:ALBUQUERQUE	07/06/88	1.34	0.12	1	9	1	9	0	7
NV:LAS VEGAS	07/25/88	1.65	0.13	-2	7	-7	8	0	7
NY:BUFFALO	07/11/88	1.48	0.13	0	9	-5	9	-2	7

Table 13 (continued)

Concentrations of Radionuclides in Pasteurized Milk

July 1988

Location	Date Collected	K		^{137}Cs		^{140}Ba		^{131}I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
NY:NEW YORK CITY	07/11/88	1.41	0.13	2	9	-4	9	2	7
NY:SYRACUSE	07/06/88	1.50	0.09	7	6	-4	6	3	5
OH:CINCINNATI	07/28/88	1.43	0.09	-2	6	1	6	1	5
OR:PORTLAND	07/08/88	1.34	0.12	12	9	-2	9	2	7
PA:PHILADELPHIA	07/05/88	1.44	0.09	6	6	-5	6	6	5
PA:PITTSBURGH	07/05/88	1.58	0.13	-1	7	-4	8	-1	7
PC:CRISTOBAL	07/28/88	1.41	0.12	11	7	-2	8	-2	7
PR:SAN JUAN	07/15/88	1.44	0.13	7	9	-5	9	6	7
SD:RAPID CITY	07/05/88	1.69	0.13	2	7	-7	8	-3	7
TN:CHATTANOOGA	07/12/88	1.46	0.13	2	9	1	9	0	7
TN:MEMPHIS	07/20/88	1.37	0.13	3	9	-5	9	4	7
VA:NORFOLK	07/29/88	1.38	0.09	11	6	-2	6	6	5
VT:BURLINGTON	07/08/88	1.54	0.12	2	7	-8	8	-3	7
WA:SEATTLE	07/01/88	1.29	0.09	3	6	0	6	3	5
WV:CHARLESTON	07/19/88	1.55	0.23	11	14	-8	19	7	15
WY:LARAMIE	07/08/88	1.76	0.13	-3	7	-7	8	-7	7

• σ = Sigma Counting Error.

Table 14

Concentrations of Radionuclides in Pasteurized Milk

August 1988

Location	Date Collected	K		^{137}Cs		^{140}Ba		^{131}I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
AL:MONTGOMERY	08/05/88	1.53	0.12	3	7	-9	8	0	7
AR:LITTLE ROCK	08/08/88	1.60	0.13	1	7	-5	8	-6	7
AZ:PHOENIX	08/09/88	1.43	0.13	6	9	-3	9	-3	7
CA:LOS ANGELES	08/05/88	1.52	0.13	3	9	1	9	5	7
CA:SACRAMENTO	08/02/88	1.57	0.12	4	7	-5	8	-4	7
CA:SAN FRANCISCO	08/01/88	1.78	0.09	1	5	-7	6	2	5
CO:DENVER	08/31/88	1.53	0.13	2	9	-5	9	1	7
CT:HARTFORD	08/01/88	1.27	0.12	3	9	-1	9	4	7
DC:WASHINGTON	08/02/88	1.51	0.13	-6	9	-5	9	-3	7
DE:WILMINGTON	08/01/88	1.44	0.13	0	9	-2	9	5	7
FL:TAMPA	08/09/88	1.58	0.13	4	7	-4	8	-9	7
GA:ATLANTA	08/12/88	1.73	0.13	4	7	1	8	10	7
HI:HONOLULU	08/02/88	1.66	0.13	-3	7	-2	8	-4	7
IA:DES MOINES	08/02/88	1.47	0.13	-1	9	-1	9	1	7
IL:CHICAGO	08/01/88	1.59	0.13	7	7	2	8	4	7
IN:INDIANAPOLIS	08/08/88	1.30	0.08	3	6	0	6	2	5
KS:WICHITA	08/15/88	1.38	0.13	2	9	-8	9	4	7
KY:LOUISVILLE	08/02/88	1.51	0.12	-1	7	0	8	0	7
LA:NEW ORLEANS	08/05/88	1.40	0.13	1	9	-7	9	6	7
MA:BOSTON	08/17/88	1.29	0.12	12	9	-6	9	6	7
MD:BALTIMORE	08/05/88	1.74	0.13	2	7	-6	8	-1	7
ME:PORTLAND	08/15/88	1.36	0.12	11	9	-6	9	6	7
MI:DETROIT	08/11/88	1.39	0.13	-1	9	5	9	1	7
MI:GRAND RAPIDS	08/08/88	1.59	0.13	-1	7	-1	8	-2	7
MN:MINNEAPOLIS	08/01/88	1.55	0.13	5	9	-2	9	5	7
MN:ST. PAUL	08/01/88	1.54	0.12	2	7	-9	8	2	7
MO:ST. LOUIS	08/03/88	1.44	0.13	6	9	-1	9	6	7
MS:JACKSON	08/10/88	1.43	0.13	1	9	-9	9	5	7
MT:HELENA	08/11/88	1.40	0.13	8	9	1	9	3	7
NC:CHARLOTTE	08/12/88	1.51	0.23	0	14	-2	20	-2	15
ND:MINOT	08/25/88	1.61	0.13	13	9	-9	9	1	7
NE:OMAHA	08/05/88	1.54	0.12	1	7	-1	8	1	7
NH:MANCHESTER	08/08/88	1.51	0.08	3	5	-1	6	-1	5
NJ:TRENTON	08/03/88	1.42	0.13	-2	9	-4	9	2	7
NM:ALBUQUERQUE	08/01/88	1.46	0.12	1	7	-7	8	2	7
NY:BUFFALO	08/08/88	1.50	0.09	2	6	1	6	3	5
NY:NEW YORK CITY	08/01/88	1.67	0.13	0	7	-5	8	-4	7

Table 14 (continued)

Concentrations of Radionuclides in Pasteurized Milk

August 1988

Location	Date Collected	K		^{137}Cs		^{140}Ba		^{131}I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
NY:SYRACUSE	08/01/88	1.66	0.13	3	7	-5	8	-2	7
OH:CINCINNATI	08/30/88	1.45	0.13	5	9	-5	9	8	7
OK:OKLAHOMA CITY	08/01/88	1.41	0.13	2	9	-5	9	3	7
OR:PORTLAND	08/03/88	1.40	0.13	2	9	4	9	0	7
PA:PHILADELPHIA	08/08/88	1.77	0.13	4	7	-9	8	-3	7
PA:PITTSBURGH	08/08/88	1.50	0.12	0	7	3	8	-4	7
PC:CRISTOBAL	08/18/88	1.37	0.13	4	9	3	9	0	7
PR:SAN JUAN	08/12/88	1.39	0.13	9	9	-4	9	6	7
SC:CHARLESTON	08/08/88	1.63	0.09	2	5	-8	6	-2	5
SD:RAPID CITY	08/01/88	1.38	0.09	5	6	-2	6	2	5
TN:CHATTANOOGA	08/08/88	1.40	0.13	4	9	-4	9	6	7
TN:KNOXVILLE	08/08/88	1.53	0.12	-3	7	-3	8	-1	7
TN:MEMPHIS	08/29/88	1.52	0.13	6	9	7	10	10	7
TX:AUSTIN	08/25/88	1.40	0.13	4	9	-2	9	2	7
TX:DALLAS	08/31/88	1.37	0.13	0	9	1	9	4	7
TX:FT. WORTH	08/09/88	1.60	0.09	1	5	-7	6	-4	5
VT:BURLINGTON	08/05/88	1.68	0.13	3	7	2	8	-2	7
WA:SEATTLE	08/05/88	1.60	0.13	-3	7	-6	8	1	7
WA:SPOKANE	08/16/88	1.37	0.09	5	6	2	6	1	5
WI:MILWAUKEE	08/30/88	1.42	0.13	-1	9	-8	9	5	7
WV:CHARLESTON	08/16/88	1.69	0.16	-4	10	-6	13	2	11
WY:LARAMIE	08/04/88	1.53	0.13	4	9	-3	9	6	7

σ = Sigma Counting Error.

Table 15

Concentrations of Radionuclides in Pasteurized Milk

September 1988

Location	Date Collected	K		^{137}Cs		^{140}Ba		^{131}I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
AL:MONTGOMERY	09/09/88	1.37	0.13	9	9	-3	9	4	7
AR:LITTLE ROCK	09/13/88	1.38	0.13	6	9	3	9	1	7
AZ:PHOENIX	09/08/88	1.46	0.13	6	9	-5	9	1	7
CA:LOS ANGELES	09/08/88	1.55	0.13	3	9	2	9	5	7
CA:SACRAMENTO	09/07/88	1.50	0.09	6	6	-4	6	2	5
CA:SAN FRANCISCO	09/08/88	1.47	0.13	13	9	-1	9	6	7
CO:DENVER	09/30/88	1.59	0.12	-3	7	-7	8	-1	7
CT:HARTFORD	09/12/88	1.41	0.13	6	9	-5	9	1	7
DC:WASHINGTON	09/12/88	1.50	0.13	-3	9	-5	9	4	7
DE:WILMINGTON	09/07/88	1.42	0.13	-2	9	-1	9	7	7
FL:TAMPA	09/07/88	1.34	0.13	8	9	5	9	2	7
GA:ATLANTA	09/01/88	1.45	0.13	5	9	-6	9	2	7
HI:HONOLULU	09/06/88	1.47	0.13	8	9	3	9	-1	7
IA:DES MOINES	09/06/88	1.40	0.13	6	9	-2	9	6	7
IL:CHICAGO	09/06/88	1.37	0.09	10	6	2	6	-3	5
IN:INDIANAPOLIS	09/06/88	1.35	0.12	-2	9	2	9	2	7
KS:WICHITA	09/12/88	1.41	0.13	6	9	-6	9	3	7
KY:LOUISVILLE	09/06/88	1.38	0.13	8	9	-3	9	6	7
MA:BOSTON	09/06/88	1.30	0.12	7	9	-2	9	-1	7
MD:BALTIMORE	09/02/88	1.53	0.09	6	6	-2	7	6	5
ME:PORTLAND	09/01/88	1.47	0.08	11	5	-1	5	3	4
MI:DETROIT	09/08/88	1.51	0.13	5	9	-7	9	9	7
MI:GRAND RAPIDS	09/06/88	1.35	0.12	5	9	-2	9	4	7
MN:MINNEAPOLIS	09/12/88	1.42	0.13	1	9	-4	9	3	7
MN:ST. PAUL	09/01/88	1.42	0.13	0	9	-9	9	1	7
MO:KANSAS CITY	09/09/88	1.38	0.13	4	9	-1	9	2	7
MO:ST. LOUIS	09/07/88	1.37	0.13	0	9	-1	9	4	7
MS:JACKSON	09/07/88	1.45	0.09	7	6	-10	6	5	5
MT:HELENA	09/12/88	1.41	0.09	1	6	-2	6	4	5
ND:MINOT	09/27/88	1.45	0.13	3	9	-3	9	8	7
NE:OMAHA	09/06/88	1.34	0.08	5	6	-2	6	5	5
NH:MANCHESTER	09/12/88	1.36	0.13	5	9	2	9	3	7
NJ:TRENTON	09/07/88	1.44	0.13	3	9	-3	9	6	7
NM:ALBUQUERQUE	09/06/88	1.50	0.09	4	6	0	6	3	5
NV:LAS VEGAS	09/06/88	1.50	0.13	7	9	-5	9	4	7
NY:BUFFALO	09/13/88	1.42	0.13	4	9	-2	9	2	7
NY:NEW YORK CITY	09/12/88	1.50	0.13	4	9	0	9	2	7

Table 15 (continued)

Concentrations of Radionuclides in Pasteurized Milk

September 1988

Location	Date Collected	K		^{137}Cs		^{140}Ba		^{131}I	
		g/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$
NY:SYRACUSE	09/07/88	1.30	0.12	5	9	-1	9	2	7
OH:CINCINNATI	09/28/88	1.47	0.13	4	9	-3	9	0	7
OK:OKLAHOMA CITY	09/12/88	1.36	0.13	7	9	5	9	4	7
OR:PORTLAND	09/12/88	1.44	0.09	3	6	3	6	6	5
PA:PHILADELPHIA	09/07/88	1.43	0.13	7	9	-3	9	2	7
PA:PITTSBURGH	09/06/88	1.33	0.12	5	9	-5	9	5	7
PC:CRISTOBAL	09/15/88	1.46	0.13	5	9	-3	9	5	7
PR:SAN JUAN	09/09/88	1.39	0.09	8	6	3	6	6	5
SC:CHARLESTON	09/14/88	1.41	0.13	7	9	6	10	8	7
SD:RAPID CITY	09/06/88	1.51	0.13	3	9	2	9	2	7
TN:CHATTANOOGA	09/06/88	1.57	0.13	9	9	4	10	0	7
TN:KNOXVILLE	09/06/88	1.36	0.12	5	9	-6	9	4	7
TN:MEMPHIS	09/28/88	1.41	0.13	2	9	-1	9	2	7
TX:AUSTIN	09/23/88	1.56	0.13	4	9	3	9	8	7
VA:NORFOLK	09/30/88	1.45	0.08	6	5	-2	5	3	4
VT:BURLINGTON	09/02/88	1.34	0.12	10	9	2	9	4	7
WA:SEATTLE	09/02/88	1.46	0.13	10	9	0	9	8	7
WA:SPOKANE	09/16/88	1.42	0.13	12	9	-4	9	6	7
WI:MILWAUKEE	09/26/88	1.52	0.13	8	9	3	9	4	7
WV:CHARLESTON	09/13/88	1.51	0.23	7	14	10	20	1	15
WY:LARAMIE	09/07/88	1.31	0.12	1	9	0	9	-4	7

σ = Sigma Counting Error.

Table 16

Strontium-90 and Strontium-89 in Pasteurized Milk
EPA Location Composites

July - September 1988

EPA Location	Date	^{90}Sr pCi/l	$\pm 2\sigma$	^{89}Sr pCi/l	$\pm 2\sigma$
AL:MONTGOMERY	07/08/88	2.2	1.2	1	7
AR:LITTLE ROCK	07/05/88	1.3	0.3	1	1
AZ:PHOENIX	07/07/88	1.2	0.7	-1	1
CA:LOS ANGELES	07/05/88	0.1	0.6	2	4
CA:SACRAMENTO	07/05/88	2.1	0.6	-2	1
CA:SAN FRANCISCO	07/06/88	0.6	0.7	-1	4
CO:DENVER	06/30/88	1.3	0.5	-2	3
CT:HARTFORD	07/11/88	2.5	0.9	-1	1
DC:WASHINGTON	07/08/88	1.0	0.7	1	1
DE:WILMINGTON	07/06/88	2.2	1.0	-1	6
FL:TAMPA	07/05/88	0.2	1.0	1	1
GA:ATLANTA	07/13/88	1.5	1.1	0	2
HI:HONOLULU	07/11/88	0.5	0.4	2	2
IA:DES MOINES	07/06/88	0.3	1.8	1	2
IL:CHICAGO	07/05/88	0.9	1.5	1	2
IN:INDIANAPOLIS	07/06/88	2.1	0.5	-3	3
KS:WICHITA	07/07/88	2.3	0.5	0	1
KY:LOUISVILLE	07/05/88	2.4	1.3	0	2
LA:NEW ORLEANS	07/01/88	3.1	1.3	-1	2
MA:BOSTON	07/13/88	2.1	0.6	0	4
MD:BALTIMORE	07/01/88	2.8	0.2	-5	2
ME:PORTLAND	07/08/88	2.8	2.2	-1	3
MI:DETROIT	07/11/88	2.2	0.5	-1	1
MI:GRAND RAPIDS	07/05/88	3.1	1.1	-1	1
MN:MINNEAPOLIS	07/11/88	2.1	0.9	-1	5
MN:ST. PAUL	07/05/88	1.1	4.2	3	5
MO:KANSAS CITY	07/15/88	2.4	1.4	-1	2
MO:ST. LOUIS	07/05/88	1.0	0.8	4	5
MS:JACKSON	07/11/88	2.6	2.8	0	4
MT:HELENA	07/12/88	0.1	1.0	2	1
NC:CHARLOTTE	07/11/88	2.3	0.9	-2	5
ND:MINOT	07/26/88	3.2	1.0	-1	1
NE:OMAHA	07/09/88	1.2	0.5	0	3
NJ:TRENTON	07/06/88	1.8	1.0	2	6
NM:ALBUQUERQUE	07/06/88	0.1	1.4	1	2
NV:LAS VEGAS	07/25/88	0.4	0.5	0	3
NY:BUFFALO	07/11/88	2.3	1.8	-1	2

Table 16 (continued)

Strontium-90 and Strontium-89 in Pasteurized Milk
EPA Location Composites

July - September 1988

EPA Location	Date	^{90}Sr pCi/l	$\pm 2\sigma$	^{89}Sr pCi/l	$\pm 2\sigma^*$
NY:NEW YORK CITY	07/11/88	2.2	0.9	-1	5
NY:SYRACUSE	07/06/88	1.9	0.6	0	1
OH:CINCINNATI	07/28/88	1.4	1.1	1	1
OK:OKLAHOMA CITY	06/30/88	2.5	0.6	-1	1
OR:PORTLAND	07/08/88	1.2	0.9	2	5
PA:PHILADELPHIA	07/05/88	2.0	0.7	0	5
PA:PITTSBURGH	07/05/88	3.6	1.7	-1	2
PC:CRISTOBAL	06/30/88	0.5	0.2	1	1
PR:SAN JUAN	07/15/88	0.0	2.0	2	3
SD:RAPID CITY	07/05/88	1.3	0.7	0	1
TN:CHATTANOOGA	07/12/88	1.3	0.9	1	1
TN:MEMPHIS	07/20/88	4.0	0.8	-1	1
VA:NORFOLK	07/01/88	1.9	1.2	-1	1
VT:BURLINGTON	07/08/88	-0.4	5.0	4	7
WA:SEATTLE	07/01/88	1.0	0.9	1	6
WV:CHARLESTON	07/19/88	2.1	0.9	-1	1
WY:LARAMIE	07/08/88	1.1	0.7	0	4

σ = Sigma Counting Error.
σ^* = Analytical Error Term.

Carbon–14 in Milk

Nine stations, chosen for wide geographical distribution, contribute milk samples for annual analysis of carbon–14. These samples are monitored for carbon–14 levels in the food chain resulting from nuclear testing. The pasteurized milk is freeze-dried and the resulting powder is pelletized for ease of combustion. Analysis consists of combusting the samples and measuring released carbon dioxide through liquid scintillation. The last carbon–14 results were for samples collected during April–May 1982 and March–May 1987. They were published in *Environmental Radiation Data: Report 54*.

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